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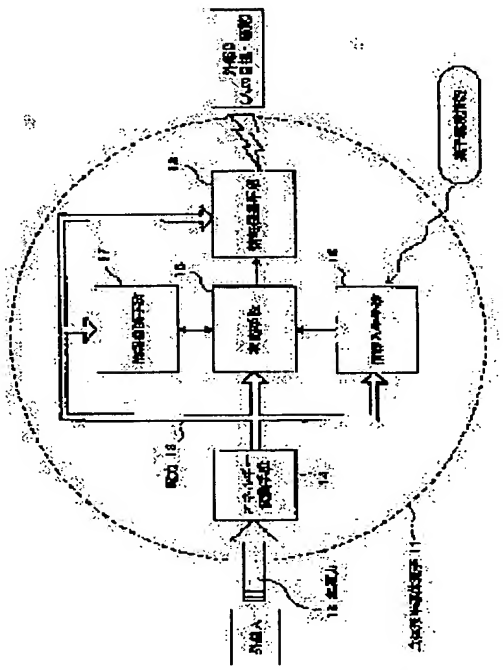
(54) THREE-DIMENSIONAL SEMICONDUCTOR DEVICE, INK TANK WHERE IT IS ARRANGED, AND INK JET RECORDING DEVICE HAVING INK TANK

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a device for extremely efficiently exchanging information bi-directionally with an external device such as an ink jet recording device by detecting detailed information in real time inside or outside such a container as an ink tank.
SOLUTION: A ball-type semiconductor device 11 is arranged inside or outside such container as the ink tank, and the device is provided with an energy conversion means 14 for converting electromotive force 12 that is supplied from outside A to the device 11 without any contact to power 13, an information acquisition means 15 for acquiring information on environment around the device, a decision means 16, an information accumulation means 17 for accumulating information for comparing with the acquisition information of the information acquisition means 15 by the decision means 16, and an information transmission means 18 for transmitting the acquisition information to the outside by the decision of the decision means 16. A non-volatile memory, namely FeRAM, that is made of a ferroelectric, is used as the information accumulation means 17, and the information acquisition means 15, decision means 16, information accumulation means 17, and information transmission means 18 are started by power obtained by the energy conversion means 14.



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CLAIMS

[Claim(s)]

[Claim 1] An energy conversion means to transform the energy from the outside into the energy of a different class, An information acquisition means by which external environmental information comes to hand, and an information storage means to accumulate the information for comparing with the acquisition information by said information acquisition means, A decision means to compare the acquisition information by said information acquisition means with the information accumulated in said information storage means corresponding to this, and to judge the need for signal transduction, When it is judged with said decision means that signal transduction is required, while having a signal transduction means to display or transmit the acquisition information by said information acquisition means to the exterior Said information acquisition means, said information storage means, said decision means, and said means of signal transduction are a solid form semiconductor device which is FeRAM which it operates with the energy changed with said energy conversion means, and said information storage means becomes from a ferroelectric.

[Claim 2] An energy conversion means to transform the energy from the outside into the energy of a different class, While having a receiving means to receive the signal from the outside, an information storage means to accumulate information, and a signal transduction means to embrace the signal received with said receiving means, and to display or transmit the information on said information storage means Said receiving means, said information storage means, and said means of signal transduction are a solid form semiconductor device which is FeRAM which it operates with the energy changed with said energy conversion means, and said information storage means becomes from a ferroelectric.

[Claim 3] An energy conversion means to transform the energy from the outside into the energy of a different class, A receiving means to receive the signal from the outside, and

an information acquisition means by which external environmental information comes to hand, An information storage means to accumulate the information for comparing with the acquisition information by said information acquisition means, Said information acquisition means is made to receive external-environment information according to the signal received with said receiving means. A decision means to make a judgment whether the acquisition information concerned is compared with the information accumulated in said information storage means corresponding to this, and said acquisition information fulfills predetermined conditions, While having a signal transduction means to display or transmit the decision result by said decision means to the exterior at least Said receiving means, said information storage means, said decision means, and said means of signal transduction are a solid form semiconductor device which is FeRAM which it operates with the energy changed with said energy conversion means, and said information storage means becomes from a ferroelectric.

[Claim 4] A solid form semiconductor device given in any 1 term of claims 1-3 whose components of said ferroelectric are PZT, PLZT, and SBT, SrTiO3, BaTiO3 or (Ba-Sr) TiO3.

[Claim 5] Said means of signal transduction is a solid form semiconductor device given in any 1 term of claims 1-4 displayed or transmitted to other solid form semiconductor devices.

[Claim 6] Said receiving means is a solid form semiconductor device according to claim 2 or 3 which also receives the signal from other solid form semiconductor devices.

[Claim 7] A solid form semiconductor device given in any 1 term of claims 1-6 which have the function which gives electromotive force to other solid form semiconductor devices.

[Claim 8] The external energy which said energy conversion means changes is a solid form semiconductor device given in any 1 term of claims 1-7 supplied by non-contact.

[Claim 9] The energy changed with said energy conversion means is a solid form semiconductor device given in any 1 term of claims 1-8 which are power.

[Claim 10] Said means of signal transduction is a solid form semiconductor device according to claim 9 changed into the field, the light, the form, the color, electric wave, or sound which is the energy for displaying the power changed by said energy conversion means to said exterior, or transmitting information.

[Claim 11] The external energy which said energy conversion means transforms into power is a solid form semiconductor device according to claim 9 which is the electromotive force by electromagnetic induction, heat, light, or the radiation.

[Claim 12] Said energy conversion means is a solid form semiconductor device given in

any 1 term of claims 1-11 which have the conductor coil and oscillator circuit which generate power by electromagnetic induction between external resonance circuits.

[Claim 13] Said conductor coil is a solid form semiconductor device according to claim 12 currently formed so that it may coil around the outside surface of a solid form semiconductor device.

[Claim 14] A solid form semiconductor device given in any 1 term of claims 1-12 further equipped with a buoyancy generating means to generate buoyancy using the energy changed with said energy conversion means.

[Claim 15] A solid form semiconductor device given in any 1 term of claims 1-12 which have the cavernous section for floating by the position in a liquid front face or liquid.

[Claim 16] The solid form semiconductor device according to claim 15 which carries out stable rocking without rotating in the liquid with which the center of gravity of said solid form semiconductor device which floats in liquid locates and floats below the core of the component concerned.

[Claim 17] The solid form semiconductor device according to claim 16 which always has the metacenter of said solid form semiconductor device in the upper part from the center of gravity of this solid form semiconductor device.

[Claim 18] The ink tank which has two or more solid form semiconductor devices of a publication in any 1 term of claims 1-17.

[Claim 19] At least one of said two or more solid form semiconductor devices is floating by the oil level of the ink in said ink tank, or the position in ink. Said two or more solid form semiconductor devices compare the acquisition information by said information acquisition means with the information accumulated in said information storage means corresponding to this. The ink tank according to claim 18 which is what outputs the decision result by said decision means to the exterior from said means of signal transduction after judging the need for signal transduction with said decision means.

[Claim 20] Other solid form semiconductor devices except the solid form semiconductor device which floats by the oil level of the ink in said ink tank among said two or more solid form semiconductor devices are being fixed to said ink tank. The solid form semiconductor device besides the above fixed to said ink tank said two or more solid form semiconductor devices by receiving the signal from said solid form semiconductor device which floats by the oil level of said ink The ink tank according to claim 19 for detecting the residue of the ink in said ink tank which it is.

[Claim 21] The ink jet recording device which carried the ink tank of a publication in any 1 term of claims 18-20.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention detects surrounding environmental information and relates to the semiconductor device which has the function which transmits and displays the information on the exterior. Moreover, this invention detects the information in an ink tank (for example, ink residue), and relates to ink jet recording devices, such as a facsimile printer, a copying machine, etc. which carries the ink tank equipped with the equipment displayed and transmitted to the exterior, and this equipment, and this ink tank removable.

[0002]

[Description of the Prior Art] There are many equipment and the devices which detect surrounding environmental information, judge based on the result, and are operated in the environment which surround us.

[0003] For example, if a cooler is taken for an example, the temperature of a current environment is detected, the comparison with the temperature set up beforehand is performed, when temperature is lower than the set point, actuation which heats is carried out, and when temperature is conversely higher than the set point, equipment is performing actuation to cool. These can constitute equipment from the former comparatively easily using a certain device, components, etc.

[0004] However, since environmental information is various not only temperature but, or the tooth space is restrained and sufficient location cannot be secured, even when components cannot be constituted, it judges based on environmental information and the present condition is that the demand of having to operate cannot respond enough by many constraint of a certain thing plentifully in an instant.

[0005] Also in the micro device field from which the application covered in many fields is expected in recent years, although research current [many] is made, for utilization, the

further examination is required.

[0006] Making ink inject as a concrete example from two or more injection nozzles prepared in the recording head, in the ink jet recording device it was made to print an image in a form by the dot pattern, he forms the ink tank which held the ink for record, and is trying to supply the ink of the ink tank to a recording head through an ink supply way by moving the carriage which carried the recording head in the printing direction. then -- if practical use is presented with the ink residue detection equipment which detected the residue of the ink of the ink tank -- being also alike -- many things are proposed.

[0007] For example, according to JP,6-143607,A, the floatage object 703 with which two electrodes (one pair) 702 were arranged by the inside by the side of the bottom of the ink tank 701 with which non-conductive ink is filled as shown in drawing 26 , and the electrode 702 and the electrode 704 in an opposite location were arranged into the ink in the ink tank 701 is floating. If two electrodes 702 are connected to the detection section (un-illustrating) which detects the switch-on of two electrodes, respectively and the switch-on of two electrodes is detected, the ink residue error which shows that there is no ink in the ink tank 701 is emitted, and stopping actuation of the ink jet recording head 705 is indicated.

[0008] Moreover, as shown in drawing 27 , while the lower part is formed in the shape of a funnel toward a base according to ****** No. 2947245, two conductors 801,802 are formed in a base and the ink cartridge 805 for ink jet printers of a configuration of that the metal ball 804 with specific gravity smaller than ink 803 is installed in the interior is indicated. With such a configuration, if ink 803 is consumed and it decreases, the oil level of ink 803 will fall. In connection with it, the location of the metal ball 804 which is floating on the front face of ink 803 falls. If the oil level of ink 803 falls to the location of the base of an ink cartridge housing, the metal ball 804 will touch two conductors 801,802. Then, since a conductor 801,802 flows, a current flows in the meantime. If the conduction is detected, ink and a condition are detectable. If ink and a condition are detected, the information which shows ink and a condition will be told to a user.

[0009]

[Problem(s) to be Solved by the Invention] As mentioned above, while developing the component which constitutes to the limited tooth space, detects surrounding environmental information, judges in an instant, and performs the next actuation, this invention persons paid their attention to the ball semiconductor of ball Semiconductor of forming a semiconductor integrated circuit on the spherical surface with a diameter of 1mm of a silicon ball. Since this ball semiconductor was a globular form, it was

expected that detection of perimeter environmental information and the exchange of the bidirectional information on the exterior can be performed very efficiently compared with a plan type. However, when the thing with such a function was investigated, the development with the above-mentioned function of the component itself is needed only by the technique which connects ball semiconductors by electric wiring like USP No. 5877943 existing. Moreover, in order for it to become clear that a means to accumulate information is indispensable in order to judge comparing with perimeter environmental information and to constitute this for a desired component, the technical problem which must be cleared occurred.

[0010] The one technical problem is the need for the new component which can hold information, without [that it can miniaturize first of all, that it can operate with little consumption energy, and] the being influenced, and can perform informational rewriting also by energy fluctuation from a current supply system further depending on the case, in order to form a means to accumulate information in a component like a ball semiconductor.

[0011] Although the configuration which detects the ink residue in an ink tank which is represented in the conventional official report is known on the other hand if the ink tank mentioned above is taken for an example, it is necessary to arrange the electrode for detection in an ink tank with such a configuration. Moreover, in order to detect an ink residue by inter-electrode switch-on, constraint will arise in the ink to be used -- a metal ion is not used for an ink component.

[0012] Moreover, with the above-mentioned configuration, only an ink residue can be detected and the exterior cannot know information in a tank on other. For example, change of the pressure information in an ink tank and ink physical properties etc. is an important parameter in order to operate an ink jet head by the always stabilized discharge quantity, and the technical problem of this invention is offering the ink tank which can tell an external ink jet recording device about the tank internal pressure which changes every moment with the ink consumption in a tank on real time, or can transmit change of ink physical properties to the exterior.

[0013] Furthermore, the technical problem of this invention is offering the ink tank which can exchange bidirectional information it not only telling to the exterior the information detected in the ink tank, but it answering a target internal information to the question from the outside on the other hand.

[0014] In order for the above-mentioned component to be a thing applicable effective in an ink tank, it is how to supply the power by starting the component held in the tank and the component which accumulates information being able to drive with low power.

Since the connecting means of a power source and a component will be needed, the manufacturing cost of a tank will increase and a tank cartridge will become expensive even when a tank becomes large-sized or it equips the tank exterior with a power source if the power source for starting of a component is given to an ink tank, it is more desirable than the exterior to start a component by non-contact.

[0015] as further technical problem, it is distance **** more fixed than the liquid ink side and oil level of an ink tank -- it is floating in ink. For example, although it is desirable to locate a component in a liquid ink side for supervising fluctuation of the amount of negative pressure accompanying the ink consumption in an ink tank with time, since a component consists of silicon with larger specific gravity than water, it is difficult for it to make ink float.

[0016] The purpose of this invention is to offer the solid form semiconductor device which can exchange detection of perimeter environmental information, and bidirectional information on the exterior very efficiently.

[0017] Moreover, the further purpose of this invention detects the detailed information in an ink tank on real time, and is to offer the ink jet recording device equipped with the ink tank which allotted the solid form semiconductor device which can exchange information in an external ink jet recording device and both directions, and this semiconductor device, and this tank.

[0018]

[Means for Solving the Problem] The solid form semiconductor device of this invention for attaining the above-mentioned purpose An energy conversion means to transform the energy from the outside into the energy of a different class, An information acquisition means by which external environmental information comes to hand, and an information storage means to accumulate the information for comparing with the acquisition information by said information acquisition means, A decision means to compare the acquisition information by said information acquisition means with the information accumulated in said information storage means corresponding to this, and to judge the need for signal transduction, When it is judged with said decision means that signal transduction is required, while having a signal transduction means to display or transmit the acquisition information by said information acquisition means to the exterior Said information acquisition means, said information storage means, said decision means, and said means of signal transduction are FeRAM(s) which it operates with the energy changed with said energy conversion means, and said information storage means becomes from a ferroelectric.

[0019] Moreover, an energy conversion means by which the solid form semiconductor

device of this invention transforms the energy from the outside into the energy of a different class, While having a receiving means to receive the signal from the outside, an information storage means to accumulate information, and a signal transduction means to embrace the signal received with said receiving means, and to display or transmit the information on said information storage means Said receiving means, said information storage means, and said means of signal transduction are FeRAM(s) which it operates with the energy changed with said energy conversion means, and said information storage means becomes from a ferroelectric.

[0020] Moreover, an energy conversion means by which the solid form semiconductor device of this invention transforms the energy from the outside into the energy of a different class, A receiving means to receive the signal from the outside, and an information acquisition means by which external environmental information comes to hand, An information storage means to accumulate the information for comparing with the acquisition information by said information acquisition means, Said information acquisition means is made to receive external-environment information according to the signal received with said receiving means. A decision means to make a judgment whether the acquisition information concerned is compared with the information accumulated in said information storage means corresponding to this, and said acquisition information fulfills predetermined conditions, While having a signal transduction means to display or transmit the decision result by said decision means to the exterior at least Said receiving means, said information storage means, said decision means, and said means of signal transduction are FeRAM(s) which it operates with the energy changed with said energy conversion means, and said information storage means becomes from a ferroelectric.

[0021] It is desirable that the components of said ferroelectric are PZT (titanic-acid lead zirconate : [the solid solution of PbZrO3 and PbTiO3]), PLZT (titanic-acid zirconic acid lanthanum lead :P ZT, i.e., the metallic oxide which added La to the solid solution of PbZrO3 and PbTiO3), and SBT (tantalic-acid strontium bismuth: Sr-Bi2-Ta 2O9), SrTiO3 (STO: strontium titanate), BaTiO3 (BTO: barium titanate) or (Ba-Sr) TiO3 (BST: barium titanate strontium).

[0022] Said means of signal transduction may be displayed or transmitted to other solid form semiconductor devices, and said receiving means may also receive the signal from other solid form semiconductor devices. The still more above solid form semiconductor devices may have the function which gives electromotive force to other solid form semiconductor devices.

[0023] As for the external energy which said energy conversion means changes in the

above solid form semiconductor devices, being supplied according to non-contact is desirable.

[0024] Moreover, in the above solid form semiconductor devices, the energy changed with said energy conversion means is power. The external energy which said energy conversion means transforms into power can consider the electromotive force by electromagnetic induction, heat, light, or the radiation.

[0025] Said means of signal transduction in this case can consider what is changed into the field, the light, the form, the color, electric wave, or sound which is the energy for displaying the power changed by said energy conversion means to said exterior, or transmitting information.

[0026] Moreover, said energy conversion means can consider what has the conductor coil and oscillator circuit which generate power by electromagnetic induction between external resonance circuits, and, as for said conductor coil, it is desirable to be formed so that it may coil around the outside surface of a solid form semiconductor device.

[0027] Moreover, what was further equipped with a buoyancy generating means to generate buoyancy using the energy changed with said energy conversion means is sufficient as the above solid form semiconductor devices.

[0028] Moreover, the above solid form semiconductor devices may have the cavernous section for floating by the position in a liquid front face or liquid.

[0029] In this case, what carries out stable rocking without rotating in the liquid with which the center of gravity of the solid form semiconductor device which floats in liquid locates and floats below the core of the component concerned is desirable, and it is desirable that the metacenter of a solid form semiconductor device is always in the upper part from the center of gravity of this solid form semiconductor device to the gravity direction.

[0030] Moreover, the ink tank of this invention has two or more above solid form semiconductor devices. In such an ink tank, at least one of said two or more solid form semiconductor devices is specifically floating by the oil level of the ink in said ink tank, or the position in ink. Said two or more solid form semiconductor devices compare the acquisition information by said information acquisition means with the information accumulated in said information storage means corresponding to this. After judging the need for signal transduction with said decision means, the decision result by said decision means is outputted to the exterior from said means of signal transduction.

[0031] Furthermore, other solid form semiconductor devices except the solid form semiconductor device which floats by the oil level of the ink in said ink tank among said two or more solid form semiconductor devices are being fixed to said ink tank. As for

said two or more solid form semiconductor devices, it is desirable that it is for detecting the residue of the ink in said ink tank by receiving the signal from said solid form semiconductor device with which the solid form semiconductor device besides the above fixed to said ink tank floats by the oil level of said ink.

[0032] Moreover, the ink jet recording device of this invention carries the above-mentioned ink tank. As for the recording device in this case, it is desirable to have a means to supply electromotive force as external energy which said energy conversion means changes into the solid form semiconductor device in an ink tank. Said electromotive force can consider electromagnetic induction, heat, light, or a radiation. Furthermore, as for the above-mentioned ink jet recording device, it is desirable to have a means to receive the transfer from a solid form semiconductor device.

[0033] In addition, the "metacenter" in this specification shows the intersection of the line of action of the weight when being in balance, and the line of action of the buoyancy when inclining.

[0034] Moreover, with the "solid form" of the "solid form semiconductor device" in this specification, all various solid forms, such as the triangle pole, a ball, a hemisphere, the square pole, a spheroid, and 1 shaft body of revolution, are included.

[0035] What is necessary is just to form a means to supply electromotive force to a component as external energy in a recovery position, a return position or carriage, a head, etc., when the supply approach of external energy is used for an ink jet recording device. It will be used for inspection etc., if the condition inside an ink tank can be known, for example, it uses in works or a dealer besides this, even if there will be no ink jet recording device, if the equipment which has a means to supply electromotive force is used (QA).

[0036] (Operation) in the solid form semiconductor device as above-mentioned, if specific energy is given by non-contact desirable ·· from the component outside, an energy conversion means will transform that external energy into different energy, and will start an information acquisition means, a decision means, an information storage means, and the means of signal transduction with this changed energy. The information acquisition means which started receives the environmental information of the perimeter of a component. Next, a decision means reads the information for referring to with acquisition information from an information storage means, compares this are recording information and acquisition information that were read, and judges the need for signal transduction. And when it is judged that there is the need for signal transduction, a decision means makes acquisition information transmit to the exterior with the means of signal transduction.

[0037] Thus, since the function which receives perimeter environmental information and is transmitted outside is made to the semiconductor device of a solid form and information acquisition and transfer are possible in three dimension, compared with the case where the semiconductor device of a monotonous form is used, there are also few limits of the direction of signal transduction. For this reason, acquisition of perimeter environmental information and transfer outside can be performed efficiently. Here, by being FeRAM (Ferroelectric Random Access Memory: ferroelectric random-access memory) of the non-volatile which an information storage means becomes from a ferroelectric, an information storage means has the rapidity of exchange of a signal that R/W of data is quick, like DRAM generally used, and even if a power source is shut off, it can hold data. On the other hand, it is possible to be able to drive by the low battery and to constitute small using a semi-conductor process. Thus, rapid access is possible for FeRAM, and since it is a non-volatile and can miniaturize with that data do not disappear and a low power even if a power source is unstable, it is possible to constitute very effectively as an information storage means of a solid form semiconductor device. When an ink tank uses a solid form semiconductor device taking advantage of the above-mentioned description, it becomes effective especially.

[0038] Furthermore, since the information according to an input signal comes to hand and a comparative judgment result with are recording information can be transmitted to the exterior with the acquisition information by adding the means of communications which receives the signal from the outside, it is also possible to exchange a signal in an external device and both directions. Here, as mentioned above, as an information storage means, by accumulating are recording information in the FeRAM, exact information processing is performed, and an exchange of an external device and a bidirectional signal is a high speed, and it becomes possible to drive by the low battery using FeRAM which consists of a ferroelectric. Furthermore, the capacitance of a solid form semiconductor device can be enlarged by utilizing the strong dielectric material of FeRAM as a capacitor. Thus, since the communication link frequency of a solid form semiconductor device can be made small by enlarging the capacitance of a solid form semiconductor device, communicating [of a solid form semiconductor device] becomes possible also for low frequency, and a communicative degree of freedom becomes high.

[0039] Moreover, it is possible to make the information about the ink which held such a solid form semiconductor device in the ink tank by allotting more than one in an ink tank, the pressure in a tank, etc. transmit to for example, an external ink jet recording device on real time. When controlling the amount of negative pressure in the tank which changes every moment for example, with ink consumption and stabilizing the ink

jet regurgitation, rapidity, a low power, and the size to which it comes from constraint of a tooth space are required, and this is these points and becomes advantageous by accumulating are recording information in FeRAM which consists of a ferroelectric.

[0040] Furthermore, since it is the configuration which supplies the external energy for operating a solid form semiconductor device by non-contact, it is not necessary to give the energy source for starting of a component to an ink tank, or to connect wiring for energy supply to a component, and giving direct wiring with the exterior can use it for a difficult part.

[0041] For example, when starting energy of a component is made into power, by forming so that the conductor coil of an oscillator circuit may be twisted around the outside surface of a solid form semiconductor device as an external energy conversion means, a conductor coil is made to generate power by electromagnetic induction between external resonance circuits, and power can be supplied to a component by non-contact.

[0042] In this case, since the coil is twisted around the outside surface of a component, the magnitude of the inductance of that coil changes according to the residue in an ink tank (for example, ink), ink concentration, and Ink pH. Therefore, since an oscillator circuit changes an oscillation frequency according to change of the inductance, it is also possible to detect the residue of the ink in an ink tank etc. based on change of the oscillation frequency changed.

[0043] And while a solid form semiconductor device has the cavernous section for floating in liquid Since the center of gravity of a component is formed so that it may be located below the core of the component concerned For example, even if the recording head and ink tank which were carried in the ink jet recording device operate serially and the ink in an ink tank rocks vertically and horizontally The information about ink, the pressure in a tank, etc. are detectable with a sufficient precision, being stabilized and floating in the ink in an ink tank. Moreover, the coil of the above-mentioned oscillator circuit formed in the component is held in the location stabilized to the coil of an external resonance circuit, and always stabilized two-way communication is also made possible.

[0044]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing. Especially the operation gestalt in the case of having arranged the component in an ink tank is explained to a detail. In addition, the same effectiveness is acquired, even if this component is not used only for an ink tank and it allots and uses it into other objects.

[0045] (Gestalt of the 1st operation) Drawing 1 is a block block diagram showing the internal configuration of the solid form semiconductor device by the gestalt of operation of the 1st of this invention, and the exchange with the exterior. The solid form semiconductor device 11 of the gestalt shown in this drawing is equipped with an energy conversion means 14 to change into power 13 the electromotive force 12 supplied by non-contact toward the component 11 from Exterior A, and an information acquisition means 15 to start with the power which obtained with the energy conversion means 14, the decision means 16, the information storage means 17 and the means 18 of signal transduction, and is allotted in an ink tank. The electromotive force supplied in order to operate a component can apply electromagnetic induction, heat, light, a radiation, etc. Moreover, as for the energy conversion means 14 and the information acquisition means 15 at least, it is desirable to be formed a front face or near a front face a component. With this operation gestalt, FeRAM (Ferroelectric Random Access Memory: ferroelectric random-access memory) which consists of a ferroelectric is used as an information storage means 17.

[0046] The information acquisition means 15 receives the information in the ink tank which is the perimeter environmental information of a component 11. The decision means 16 compares the information memorized for the tank internal information which came to hand from the information acquisition means 15, and the information storage means 17, and judges whether it is necessary to transmit the tank internal information which came to hand to the exterior. The information storage means 17 accumulates the tank internal information which came to hand from the terms and conditions in comparison with the tank internal information coming to hand, or the information acquisition means 15. With the instruction of the decision means 16, the means 18 of signal transduction is changed into the energy for transmitting to tank internal information, displays ink internal information on Exterior B, and transmits power to it.

[0047] Drawing 2 is a flow chart for explaining actuation of the component shown in drawing 1 . If drawing 1 and drawing 2 are referred to and electromotive force 12 will be given toward a component 11 from Exterior A, the energy conversion means 14 will change electromotive force 12 into power 13, and will start the information acquisition means 15, the decision means 16, the information storage means 17, and the means 18 of signal transduction with the power.

[0048] The information acquisition means 15 which started receives information, such as the information in the ink tank which is the environmental information of the perimeter of a component, for example, the residue of ink, a class of ink, temperature, and pH, (step S11 of drawing 2). Next, the decision means 16 reads the conditions for

referring to with the tank internal information which came to hand from the information storage means 17 (step S12 of drawing 2), compares this read condition with the tank internal information which came to hand, and judges the need for signal transduction (step S13 of drawing 2). Here, since for example, the ink residue became 2ml or less, or pH of ink is large and it changed, as for the decision based on the conditions beforehand set as the information storage means 17, it is mentioned that tank exchange makes a judgment with the need.

[0049] When it is judged that the decision means 16 does not need to transmit the information in a tank to the exterior in step S13, the information in the present ink tank is accumulated in the information storage means 17 (step S14 of drawing 2). The information and the decision means 16 which the information acquisition means 15 received next may compare this are recording information.

[0050] Moreover, in step S13, when it is judged that the decision means 16 needs to transmit the information in a tank to the exterior, the power obtained by energy conversion is transformed into the energy for transmitting the information in an ink tank to the exterior with the means 18 of signal transduction. It transmits that the energy for [this] transmitting can use a field, light, a form, a color, an electric wave, a sound, etc., for example, sound a sound and tank exchange is required when an ink residue is judged to have become 2ml or less to Exterior B (for example, ink jet recording device) (step S15 of drawing 2). Moreover, especially in the case of light, a form, a color, a sound, etc., a transfer place may transmit to people's vision and acoustic sense only not only in an ink jet recording device. Furthermore, to a sound, when it is judged that the ink residue became 2ml or less, when pH of ink changes a lot, the transfer approach may be changed according to information, such as telling about with light.

[0051] What is necessary is just to form a means to supply electromotive force to a component as external energy in a recovery position, a return position or carriage, a head, etc., when used for an ink jet recording device. It will be used for inspection etc., if the condition inside an ink tank can be known, for example, it uses in works or a dealer besides this, even if there will be no ink jet recording device, if the equipment which has a means to supply electromotive force is used (QA).

[0052] According to this operation gestalt, since the component has the energy conversion means, a component can be used even if it is which part in [, such as inside of ink as it becoming unnecessary to perform direct electric wiring with the exterior, and performing direct electric wiring with the exterior shows to a difficult part, for example drawing 11 , - drawing 14 ,] an object. If a component is allotted into ink, it will become

possible to grasp the condition of ink correctly on real time.

[0053] Moreover, since the component has the energy conversion means and it becomes unnecessary to arrange a means (this example power source) to accumulate the electromotive force for operating a component, the miniaturization of a component is attained, and a component can be used even if it is which part in [, such as inside of ink,] an object like a narrow part or drawing 11 - drawing 14 . In addition, although electromotive force was supplied by non-contact at this example, after contacting the exterior temporarily and supplying electromotive force, the gestalt used as the exterior and non-contact is sufficient.

[0054] With this operation gestalt, as mentioned above, FeRAM which consists of a ferroelectric is used as an information storage means 17. Thereby, the information storage means 17 has the rapidity that R/W of data is quick, like DRAM (Dynamic Random Access Memory) generally used, and even if a power source is shut off, it serves as nonvolatile memory which can hold data. Thus, when it uses a solid form semiconductor device by the ink tank that data do not disappear even when its power source is unstable, since FeRAM(s) are that rapid access is possible and a non-volatile, it becomes effective. Thus, by accumulating are recording information in FeRAM, exact information processing is performed, and an exchange of an external device and a bidirectional signal is a high speed, and it becomes possible to drive by the low battery. On the other hand, it is possible to be able to drive by the low battery and to constitute small using a semi-conductor process. Thus, rapid access is possible for FeRAM, and since it is a non-volatile and can miniaturize with that data do not disappear and a low power even if a power source is unstable, it is possible to constitute very effectively as an information storage means of a solid form semiconductor device. When an ink tank uses a solid form semiconductor device taking advantage of the above-mentioned description so that it may mention later, it becomes effective especially.

[0055] Moreover, in this way, if the information storage means 17 utilizes the strong dielectric material of FeRAM as a capacitor by being FeRAM which consists of a ferroelectric, it can enlarge the capacitance of a solid form semiconductor device. Thus, since the communication link frequency of a solid form semiconductor device can be made small so that it may mention later also in case a solid form semiconductor device performs an exchange of an external device and a signal by enlarging the capacitance of a solid form semiconductor device, communicating [of a solid form semiconductor device] becomes possible also for low frequency, and a communicative degree of freedom becomes high.

[0056] (Gestalt of the 2nd operation) Drawing 3 is a block block diagram showing the

internal configuration of the solid form semiconductor device by the gestalt of operation of the 2nd of this invention, and the exchange with the exterior. The solid form semiconductor device 21 of the gestalt shown in this drawing is equipped with an energy conversion means 24 to change into power 23 the electromotive force 22 supplied by non-contact toward the component 21 from Exterior A, an information acquisition means 25 to start with the power which obtained with the energy conversion means 24, the decision means 26, the information storage means 27 and the means 28 of signal transduction, and the receiving means 29, and is allotted in an ink tank. It differs from the gestalt of the 1st operation in that it has a reception function. Moreover, the electromotive force supplied in order to operate a component can apply electromagnetic induction, heat, light, a radiation, etc. Moreover, as for the energy conversion means 24, the information acquisition means 25, and the receiving means 29 at least, it is desirable to be formed a front face or near a front face a component. Also in this operation gestalt, FeRAM which consists of a ferroelectric is used as an information storage means 27.

[0057] The information acquisition means 25 receives the information in the ink tank which is the perimeter environmental information of a component 21. The receiving means 29 receives the input signal 20 from Exterior A or Outside B. According to the input signal from the receiving means 29, the decision means 26 makes the information acquisition means 25 receive tank internal information, compares the information memorized for this tank internal information that came to hand, and the information storage means 27, and judges whether the tank internal information which came to hand fulfills predetermined conditions. The information storage means 27 accumulates the tank internal information which came to hand from the terms and conditions in comparison with the tank internal information coming to hand, or the information acquisition means 25. With the instruction of the decision means 26, the means 28 of signal transduction transforms power into the energy for transmitting to tank internal information, and displays and transmits the decision result by the decision means 26 to Exterior A, Exterior B, or Exterior C.

[0058] Drawing 4 is a flow chart for explaining actuation of the component shown in drawing 3 . If drawing 3 and drawing 4 are referred to and electromotive force 22 will be given toward a component 21 from Exterior A, the energy conversion means 24 will change electromotive force 22 into power 23, and will start the information acquisition means 25, the decision means 26, the information storage means 27, the means 28 of signal transduction, and the receiving means 29 with the power.

[0059] In this condition, the signal 30 for hearing the information in an ink tank from

Exterior A or Outside B at a component 21 is transmitted. This input signal 30 is a signal for asking for a component whether ink still remains for example, in the ink tank, and is received by the receiving means 29 (step S21 of drawing 4). Then, the decision means 26 reads the conditions for making information, such as the information in an ink tank, for example, the residue of ink, a class of ink, temperature, and pH, come to hand with the information acquisition means 25 (step S22 of drawing 4), and referring to with the tank internal information which came to hand from the information storage means 27 (step S23 of drawing 2 R> 2), and judges whether the tank internal information which came to hand fills setups (step S24 of drawing 4).

[0060] When it is judged that acquisition information fulfills the purport which is not fulfilled for setups when it is judged that acquisition information does not fill setups in step S24, the purport currently fulfilled is transmitted to Exterior A, Exterior B, or Exterior C (steps S25 and S26). At this time, it may combine with a decision result and acquisition information may also be transmitted. This transfer is the means 28 of signal transduction about the power obtained by energy conversion, and is performed by changing into the energy for transmitting the information in an ink tank to the exterior. The energy for [this] transmitting can use a field, light, a form, a color, an electric wave, a sound, etc., it may be made to change according to a decision result, and that transfer approach may be changed according to for example, the contents of a question which should be judged -- whether an ink residue is 2ml or less or pH of ink is changing.

[0061] In addition, in the case of the signal for also giving electromotive force to a component 21 with the input signal 30 from Exterior A or Outside B, for example, hearing it about the residue of ink, when the electromotive force is electromagnetic induction, and light, uses, such as a signal for hearing pH, may be divided and given.

[0062] Since it has the function to receive the signal from the outside according to this operation gestalt, in addition to the effectiveness by the gestalt of the 1st operation, it becomes possible to answer to the question by the signal of various classes from the outside, and information can be exchanged in a component and the exterior.

[0063] In addition, although it should have the information acquisition means since the suitable component to allot in an ink tank was described, it does not have this but the solid form semiconductor device which outputs outside the information beforehand memorized for the component according to the input signal from the outside is considered as the basic configuration of this operation gestalt.

[0064] (Gestalt of the 3rd operation) Drawing 5 is a block block diagram showing the internal configuration of the solid form semiconductor device by the gestalt of operation of the 3rd of this invention, and the exchange with the exterior. The solid form

semiconductor device 31 of the gestalt shown in this drawing is equipped with an energy conversion means 34 to change into power 33 the electromotive force 32 supplied by non-contact toward the component 31 from Exterior A, and a buoyancy generating means 35 to generate buoyancy using the power which obtained with the energy conversion means 34, and is allotted into the ink in an ink tank.

[0065] When electromotive force 32 is given toward a component 31 from Exterior A, the energy conversion means 34 changes electromotive force 32 into power 33, and the buoyancy generating means 35 generates buoyancy and makes a component 31 float in respect of liquid ink with such a gestalt using the power 33. In order to prevent, you may make it, as for this buoyancy, the location of a component not necessarily exist in a fixed distance lower part from a liquid ink side surely that not only a liquid ink side but ink performs the regurgitation by the state of the sky.

[0066] For example, the location of the component which made drawing 6 float in the ink of an ink tank is shown with consumption change of ink. By the tank as shown in drawing 6 , the ink of a part consumed in connection with the ink of the negative pressure generating member 37 being drawn outside from the ink feed hopper 36 is held at the negative pressure generating member 37. Thereby, the solid form component 31 in raw ink 38 is in the condition which existed in the fixed distance lower part from the liquid ink side H, and moves with the fall of the location of the liquid ink side H by consumption of ink.

[0067] Drawing 7 is a flow chart for checking the location of a component 31 and judging the need for tank exchange. If drawing 5 R> 5 and steps S31-S34 of drawing 7 are referred to, light will be sent towards a component 31 by Exterior A or Exterior B (for example, ink jet recording device). The location of a component 31 is detected by receiving the light in Exterior A, Exterior B (for example, ink jet recording device), or Exterior C. An ink jet recording device judges whether there is any need for ink tank exchange with the location of this component, and when there is need, a sound, light, etc. report tank exchange.

[0068] A luminescence means and a light-receiving means counter and, as for detection of the location of this component, are established, and when the part of a component does not let light pass, the thing by which a location is checked, or the thing by which the light emitted from the luminescence means is checked by reflecting towards a light-receiving means is used.

[0069] It is possible for it not to be concerned with the environment where a component is placed since it can set up so that the electromotive force from the outside may be changed with an energy conversion means when a buoyancy required for a component

etc. changes with the environments where a component [differ / according to this operation gestalt / the specific gravity of a liquid] is used, and a component may always exist in a desired location, but to use a component.

[0070] In addition, this operation gestalt can also be suitably combined with the gestalt of the 1st mentioned above and the 2nd operation.

[0071] (Gestalt of the 4th operation) Drawing 8 is a conceptual diagram for explaining the operation of the solid form semiconductor device which is the gestalt of operation of the 4th of this invention.

[0072] This operation gestalt is a configuration which gave the function to transmit information at other components to the solid form semiconductor device of the 1st or 2nd operation gestalt, and has arranged two or more these in an object.

[0073] If two or more solid form semiconductor devices of the gestalt of the 1st operation are allotted into the object and electromotive force is supplied to each component from Exterior A or Exterior B in the example of drawing 8 (A) Each component receives perimeter environmental information, respectively, acquisition information a on a component 41 is carried out to a component 42, the sequential transfer of the acquisition information a and b on a component 41 and a component 42 is carried out to the following component, and, as for the last component 43, all acquisition information is transmitted to Exterior A or Exterior B.

[0074] Moreover, in the example of drawing 8 (B), two or more solid form semiconductor devices of the gestalt of the 2nd operation are allotted into an object. If electromotive force is supplied to each component from Exterior A or Exterior B and the predetermined question by the signal is inputted into a component 53 from Exterior A or Exterior B The component 51 corresponding to the contents of a question or 52 answers by the information according to a question coming to hand, and the sequential transfer of a component 51 or the question reply of 52 is carried out to other components, and it is answered to it from the desired component 53 to Exterior A, Exterior B, or Exterior C.

[0075] Moreover, in the example of drawing 8 (C), two or more solid form semiconductor devices of the gestalt of the 2nd operation are allotted into an object, electromotive force is supplied to each component from Exterior A or Exterior B, if a certain signal is inputted from Exterior A or Exterior B to a component 63, sequential transfer will be carried out to a component 62 and a component 61, and the signal will display on Exterior A, Exterior B, or Exterior C by the component 63.

[0076] In addition, in the example of drawing 8 (A) - (C), what equipped one of two or more of the solid form semiconductor devices with the buoyancy generating means of the gestalt of the 3rd operation may be used.

[0077] Moreover, drawing 9 shows the example which has arranged the solid form semiconductor device which combined suitably the gestalt of the 1st, the 2nd, or the 3rd operation, respectively in the ink jet head linked to the inside of an ink tank, and this. In this example, the solid form semiconductor device 71 which added the communicative function to the buoyancy generating means and other components 79 of a gestalt of the 3rd operation to the gestalt of the 1st operation is arranged in the location of the request in the ink 73 of the ink tank 72. The solid form semiconductor device 79 of the gestalt of the 2nd operation which equipped with ID function (authentication function) the recording head 78 which carries out the regurgitation from a delivery 77 for printing of the ink supplied on the other hand through the liquid route 75 and the liquid room 76 which were connected with the ink feed hopper 74 of the ink tank 72 is arranged. Contact in the contact section on the electric substrate for driving the polar zone and recording head 78 which were allotted to the component front face may perform the electric power supply to this component 79.

[0078] And if electromotive force is supplied to each components 71 and 79 from the exterior, the component 71 in ink will receive the residue information on ink, and the component 79 by the side of a recording head will transmit ID information which judges the ink residue for for example, tank exchange to a component 71. Then, a component 71 compares the ink residue and ID which came to hand, and only when in agreement, it carries out transfer directions so that a component 79 may be told about tank exchange to the exterior. A component 79 transmits the signal which receives this and tells tank exchange outside, or outputs a sound, light, etc. of which it complains to people's eye and acoustic sense.

[0079] As mentioned above, it becomes possible to set up the conditions of complicated information by allotting two or more components into a certain object.

[0080] Moreover, although considered as the configuration which supplies electromotive force to each solid form semiconductor device in the example shown in drawing 8 and drawing 9 , you may be the configuration which carries out the sequential transfer of the electromotive force supplied not only to this but to a certain component with information at other components. for example, the solid form semiconductor device 81 which added the buoyancy generating means of the gestalt of the 3rd operation, the communicative function to other components, and the electromotive force supply function to the gestalt of the 1st operation as shown in drawing 10 -- and The solid form semiconductor device 82 which added the buoyancy generating means of the gestalt of the 3rd operation, the communicative function to other components, and the electromotive force supply function to the gestalt of the 2nd operation is arranged in the

location of the request in the ink 73 of the same ink tank 72 as drawing 9 R> 9, respectively. The solid form semiconductor device 83 of the gestalt of the 2nd operation which, on the other hand, equipped with ID function (authentication function) the recording head 78 connected with the ink tank 72 is arranged. Contact in the contact section on the electric substrate for driving the polar zone and recording head 78 which were allotted to the component front face may perform the electric power supply to this component 83.

[0081] And if electromotive force is supplied to a component 81 from the exterior, the component 81 in ink will receive the residue information on ink, and will transmit the ink residue information which received this information when there was the need for transfer to other components as compared with an internal provision to a component 82 with the electromotive force which operates a component 82. The component 82 to which electromotive force was supplied receives the information about pH of ink, for example, and transmits the electromotive force which operates a component 83 for the component 83 by the side of a recording head while it receives the ink residue information transmitted from the component 81. Then, the component 83 by the side of the recording head to which electromotive force was supplied transmits ID information which judges the ink residue for for example, tank exchange, or pH of ink to a component 82. And a component 82 compares with ID the ink residue information and pH information which came to hand, and only when in agreement, it carries out transfer directions so that a component 83 may be told about tank exchange to the exterior. A component 83 transmits the signal which receives this and tells tank exchange outside, or outputs a sound, light, etc. of which it complains to people's eye and acoustic sense. Thus, how to supply electromotive force to other components with information from a certain component is also considered.

[0082] In addition, ink is made to foam to a recording head 78 with the heat of electric thermal-conversion components, such as a heater, in a liquid route, and it can consider what carries out the regurgitation of the ink from a liquid route and minute opening open for free passage with the cellular growth energy.

[0083] (Gestalt of other operations) The example of a configuration of the ink tank which can apply the solid form semiconductor device of the gestalt of operation mentioned above is shown in drawing 11 - drawing 14 . The ink tank 501 shown in drawing 11 arranges the flexible ink bag 502 which contained ink in a case 503, closes bag mouth 502a with the rubber stopper 504 fixed to the case 503, is thrusting the hollow needle 505 for ink derivation into a rubber stopper 504, and making it open for free passage in a bag, and performs ink supply to a non-illustrated ink jet head. The

solid form semiconductor device 506 of this invention can be arranged in the ink bag 502 of such an ink tank 501.

[0084] Moreover, the ink tank 511 shown in drawing 12 attaches the ink jet head 515 which turns ink to the detail paper S and performs discharge record to the ink feed hopper 514 of the case 512 which held ink 513. The solid form semiconductor device 516 of this invention can be arranged in the ink 513 in such a tank 511.

[0085] Moreover, the ink tanks 521 shown in drawing 13 are the tank shown in drawing 6 , drawing 9 , and drawing 10 , and same tank, and are equipped with the 1st room in the full sealing condition of holding ink 522, the 2nd room of the atmospheric-air free passage condition which contains the negative pressure generating member 523, and the free passage way 524 that makes the 1st room and the 2nd room open for free passage at the tank bottom. If ink is consumed from the ink feed hopper 525 by the side of the 2nd room, from the 2nd room side, it will replace that atmospheric air goes into the 1st room, and the ink 522 of the 1st room will be drawn by the 2nd room. The information about the ink of each ** which allotted the solid form semiconductor device 526,527 of this invention to the 1st room and the 2nd room, respectively, and was divided into it in the tank 521 of such a configuration may be exchanged.

[0086] Moreover, the ink tank 531 shown in drawing 14 contains the porosity member 532 holding ink, and attaches the ink jet head 533 which uses receipt ink for record. Also in the tank 531 of such a configuration, like the tank shown in drawing 9 and drawing 10 , the solid form semiconductor device 534,535 of this invention may be allotted to an ink tank and ink jet head side, respectively, and the information about the divided ink of each configuration circles may be exchanged.

[0087] Next, a schematic diagram shows the example of a configuration of the ink jet recording device carrying the ink tank equipped with the solid form semiconductor device of this invention to drawing 15 . The head cartlidge 601 carried in the ink jet recording apparatus 600 shown in drawing 15 has the liquid discharge head which carries out the regurgitation of the ink for printing record, and an ink tank as shown in drawing 11 holding the liquid supplied to the liquid discharge head - drawing 14 . Moreover, a means 622 to supply the electromotive force which is external energy to the solid form semiconductor device allotted in this ink tank, and a means (un-illustrating) to communicate said component and information bidirectionally are installed in the recording device 600.

[0088] The head cartlidge 601 is carried on the carriage 607 engaged to the spiral slot 606 of a leading screw 605 which is interlocked with the forward inverse rotation of a drive motor 602, and is rotated through the driving force transfer gears 603 and 604, as

shown in drawing 15 . Along with a guide 608 in carriage 607, both-way migration of the head cartlidge 601 is carried out in the direction of arrow heads a and b by the power of a drive motor 602. The ink jet recording apparatus 600 is equipped with a recorded-media conveyance means (un-illustrating) to convey the print form P as recorded media which receive liquids, such as ink breathed out from the head cartlidge 601. The paper presser-foot plate 610 of the print form P which has a platen 609 top conveyed presses the print form P to a platen 609 covering the migration direction of carriage 607 with the recorded-media conveyance means.

[0089] Photo couplers 611 and 612 are arranged near the end of a leading screw 605. Photo couplers 611 and 612 are the home-position detection means for checking existence [in the field of photo couplers 611 and 612 of lever 607a of carriage 607], and performing a switch of the hand of cut of a drive motor 602 etc. Near the end of a platen 609, it has the supporter material 613 which supports the wrap cap member 614 in the front face with the delivery of a head cartlidge 601. Moreover, it has an ink suction means 615 to attract the ink with which air ejecting etc. was carried out from the head cartlidge 601, and the interior of the cap member 614 was covered. Suction recovery of a head cartlidge 601 is performed by this ink suction means 615 through opening of the cap member 614.

[0090] The ink jet recording device 600 is equipped with the body base material 619. The migration member 618 is supported by this body base material 619 movable in the right-angled direction to the cross direction, i.e., the migration direction of carriage 607. The cleaning blade 617 is attached in the migration member 618. A cleaning blade 617 may be a well-known cleaning blade of not only this gestalt but other gestalten. Furthermore, it has the lever 620 for starting suction in the suction recovery operation by the ink suction means 615, and it moves with migration of the cam 621 which engages with carriage 607, and, as for a lever 620, migration control of the driving force from a drive motor 602 is carried out with a means of communication with a well-known clutch switch etc. The ink jet record control section which gives a signal to the heating element prepared in the head cartlidge 601, or manages drive control of each device mentioned above is prepared in the body side of a recording device, and is not shown by drawing 15 .

[0091] In the ink jet recording device 600 which has the configuration mentioned above, a head cartlidge 601 carries out both-way migration covering full [of the print form P] to the print form P which has a platen 609 top conveyed by the aforementioned recorded-media conveyance means. If a driving signal is supplied to a head cartlidge 601 from a driving signal supply means by which it does not illustrate at the time of this

migration, according to this signal, ink (record liquid) will be breathed out from the liquid discharge-head section to recorded media, and record will be performed.

[0092]

[Example] Next, the desirable example in the case of arranging the solid form semiconductor device of this invention in an ink tank is explained in more detail.

[0093] First, an information acquisition means applicable to the solid form semiconductor device of this invention is mentioned as an example. When the solid form semiconductor device arranged in an ink tank is made by spherical silicon, as an information acquisition means explained with the gestalt of the above-mentioned operation (1) The sensor which makes SiO2 film and the SiN film as an ion sensing membrane, and detects pH of ink, (2) The pressure sensor which has diaphram structure and detects the pressure variation in a tank, (3) Light is changed into heat energy, the photodiode which has a pyroelectric effect is made, a current location is detected, and the sensor which detects an ink residue, the sensor which detects ink existence with the moisture content in a tank using the electric conduction effectiveness of (4) ingredients can be mentioned.

[0094] Next, the example of an energy conversion means applicable to the solid form semiconductor device of this invention is given. Drawing 16 is drawing for explaining the power generating principle of the energy conversion means which is the component of the solid form semiconductor device of this invention.

[0095] In drawing 16 , if the coil La of the external resonance circuit 101 is adjoined, the conductor coil L of an oscillator circuit 102 is placed and Current Ia is passed in Coil La through the external resonance circuit 101, the magnetic flux B which pierces through the coil L of an oscillator circuit 102 according to Current Ia will arise. Here, since the magnetic flux B which pierces through Coil L will change if Current Ia is changed, induced electromotive force V arises in Coil L. Therefore, the oscillator circuit 102 as an energy conversion means is made to spherical silicon, and the power which operates a component can be generated in the induced electromotive force by the electromagnetic induction from the outside by arranging the external resonance circuit 101 for example, in the ink jet recording device of the component exterior so that the conductor coil L of the oscillator circuit 102 by the side of a component and the coil La of the resonance circuit 101 of the component exterior may adjoin.

[0096] Moreover, since the magnetic flux B which pierces through the coil L of number-of-turns N of an oscillator circuit 102 made as an energy conversion means to spherical silicon is proportional to number-of-turns Na of the coil La of the external resonance circuit 101, and the product of Current Ia, it sets a proportionality constant

to k, and it is [0097].

[Equation 1]

The electromotive force V produced in the B=k*Na*Ia ** coil L is [0098].

[Equation 2]

V=-N{dB/dt}

=-kNaN{dIa/dt}

= -M {dIa/dt} [** -- if magnetic flux B sets the permeability of the core of a coil to mua and it sets a field to H here -- 0099]

[Equation 3]

B=mu aH (z)

= It becomes {muaNaIara2/2(ra2+z2) 3/2 **. Here, z shows the distance of the coil of an external resonance circuit, and the coil made to spherical silicon.

[0100] ** The mutual inductance of a formula : M is [0101].

[Equation 4]

M= {mu N/mu aIa} integralsB-dS It becomes ={mumuara2NaNS/2micro0(ra2+z2) 3 / 2} **. Here, mu 0 is space permeability.

[0102] And impedance:Z of the dispatch circuit made to spherical silicon is [0103].

[Equation 5]

Z(omega) =R+j {omegaL- (1-/omegaC)} It is expressed **, and impedance:Za of an external resonance circuit is [0104].

[Equation 6]

. used as Za(omega) = Ra+jomegaLa-{omega2M2/Z(omega)} ** -- here, J expresses magnetization. And an impedance when this external resonance circuit resonates (current value: when Ia becomes max): Z0 is [0105].

[Equation 7]

Becoming Z0(omega 0) =Ra+jLaomega0-(omega02M2/R) **, delay:phi of the phase of this resonance circuit is [0106].

[Equation 8]

It becomes tanphi={jLaomega0-(omega02M2/R)}/R **.

[0107] And resonance frequency of this external resonance circuit: f0 is [0108].

[Equation 9]

It asks by f0=1/2pi(LC) 1/2 **.

[0109] If the impedance of the oscillator circuit 102 made to spherical silicon carries out adjustable from the above relation according to change of the ink in an ink tank, the frequency of the external resonance circuit 101 will be changed and change of the above-mentioned ink will appear in the amplitude and phase contrast of an impedance

of the external resonance circuit 101. Furthermore, the ink residue (namely, change of z) is also contained in this phase contrast and amplitude.

[0110] For example, since the output (impedance) from the oscillator circuit 102 made to spherical silicon changes according to a surrounding environmental variation by carrying out adjustable [of the resonance frequency of the external resonance circuit 101], the existence and the ink residue of ink are detectable by detecting frequency dependent [this].

[0111] Therefore, only as an energy conversion means to generate power, the oscillator circuit made to spherical silicon is the relation of the oscillator circuit and external resonance circuit, and can be used also as a part of means to detect change of the ink in a tank.

[0112] Next, the manufacture approach of the solid form semiconductor device of this example is explained. Drawing 17 is process drawing for explaining an example of the manufacture approach of the solid form semiconductor device of this invention, and shows each process in the cross section passing through the core of spherical silicon. Moreover, the center of gravity of spherical silicon is created so that it may become below a core, and the upper part inside a spherical-surface object is made into a cavity, and the manufacture approach of holding the cavernous section in the airtight condition is further mentioned as an example here.

[0113] In order to form opening 203 in some SiO2 film as shown in drawing 17 (c) after forming SiO2 film 202 of thermal oxidation on [all] a front face to the spherical silicon shown in drawing 17 (a), as shown in drawing 17 (b), patterning is carried out using a photolithography process.

[0114] And as shown in drawing 17 (d), by the anisotropic etching using the KOH solution which leads opening 203, only a upside silicon part removes and the cavernous section 204 is formed. then, it is shown in drawing 17 (e) -- as -- LPCVD -- the SiN film 205 is formed in the inside-and-outside front face of a solid form component using law.

[0115] Furthermore, as shown in drawing 17 (f), the Cu film 206 is formed on all the front faces of a solid form component using a metal CVD method. And as shown in drawing 17 (g), patterning of the Cu film 206 is carried out using a well-known photolithography process, and the conductor coil L of number-of-turns N which is a part of oscillator circuit is formed. Then, the solid form component in which the conductor coil L was formed is taken out from vacuum devices into atmospheric air, the closure members 207, such as resin and a plug, close the upside opening 203, and the cavernous section 204 inside a spherical-surface object is changed into a sealing condition. Thus, if it manufactures, buoyancy can be given to the solid form semiconductor device itself

which consists of silicon even if it does not have a means to generate buoyancy using power like the gestalt of the 3rd operation.

[0116] Moreover, before manufacturing the solid form semiconductor device of such a suspension mold, drive circuit elements other than the coil L formed in spherical silicon use N-MOS circuit component. The typical sectional view cut so that it might travel through N-MOS circuit component to drawing 18 is shown.

[0117] According to drawing 18 , by the impurity installation and diffusion of an ion plantation etc. using a general Mos process, P-Mos450 is constituted by the N type well field 402, and N-Mos451 is constituted by the Si substrate 401 of P conductor to the P type well field 403. P-Mos450 and N-Mos451 consist of the source fields 405 and drain field 406 grades which carried out impurity installation of the gate wiring 415 by poly-Si deposited on 4000A or more the thickness of 5000A or less with the CVD method through gate dielectric film 408 of 100A of thickness numbers, respectively and N type, or P type, and C-Mos logic is constituted by these P-Mos450 and N-Mos451.

[0118] The N-Mos transistor 301 for a component drive is too constituted from a drain field 411 on the P type well substrate 402, a source field 412, and gate wiring 413 grade by processes, such as impurity installation and diffusion.

[0119] Here, if the N-Mos transistor 301 is used as a component drive driver, the distance L between the drain gates which constitute one transistor will be set to about 10 micrometers at the minimum value. although one of the 10-micrometer items of the is the width of face of the source and the contact 417 of a drain and the amount of [2x2-micrometer] those width of face is, since the one half serves as combination with the next transistor in practice -- 2 micrometers of 1/the 2 -- it is . Everything but the items is 4 micrometers for the width of face of 2x2 micrometers [for the distance of contact 417 and the gate 413] 4 micrometers, and the gate 413, and is set to a total of 10 micrometers.

[0120] Between each component, the oxide-film isolation region 453 is formed of with a 5000A or more thickness [thickness 10000A or less] field oxidation, and it is detached by the component. This field oxide acts as an accumulation layer 414 of an eye further.

[0121] After each component is formed, and an interlayer insulation film 416 accumulates on the thickness which is about 7000A by PSG by the CVD method, the BPSG film, etc. and is made it by heat treatment in flattening processing etc., wiring is performed through the contact hole by the aluminum electrode 417 used as the 1st wiring layer. Then, the interlayer insulation films 418, such as SiO2 film by the plasma-CVD method, were deposited on 10000A or more the thickness of 15000A or less, and the through hole was formed further.

[0122] This N-Mos circuit is formed before forming the solid form semiconductor device of a suspension mold like drawing 17 . And connection with the sensor section as FeRAM as an information storage means in the solid form semiconductor device of this invention, and the oscillator circuit as an energy conversion means and an information acquisition means etc. is made through the above-mentioned through hole.

[0123] As shown in drawing 19 (a), the cellular structure of this FeRAM, i.e., the cellular structure of ferroelectric random-access memory, has the composition that the ferroelectric capacitor which carries out the laminating of the plate line (lower electrode) 352, a ferroelectric 350, and the up electrode 351 one by one, and becomes was formed on the semi-conductor substrate with the bit line 353 and the WORD line 354. A 1T1C mold cel as shown in drawing 19 (b), and a 2T2C mold cel drawing 19 (c) As shown can be constituted using this cellular structure.

[0124] Moreover, the magnetic flux (field) stabilized in any conditions by the ink tank which allotted the solid form semiconductor device of the suspension mold of this example between the oscillator circuit made from the above processes by spherical silicon and the external resonance circuit shown in drawing 16 needs to be working. However, when it floats in liquids, such as ink, an oil level may vibrate by extraneous vibration. Even in such a case, in order to hold the condition of having been stabilized in the liquid, in this example, the center of gravity of the solid form semiconductor device of a suspension mold is determined.

[0125] When the ball form semiconductor device 210 of this example is made to float in a liquid as drawing 20 shows, in order to be in the condition of balance, it is required like drawing 20 (a) to realize relation called coincidence in the line of action of the weight W (2) buoyancy of a (1) buoyancy F= body and the line of action (line passing through a center of gravity G) of weight.

[0126] And when a liquid vibrates according to external force and the solid form semiconductor device 210 inclines for a while from the condition of balance like drawing 20 (b), center of buoyancy moves and it becomes a couple by buoyancy and weight.

[0127] Here, the distance h of a metacenter, a call and a metacenter, and a center of gravity is called the height of a metacenter in the intersection of the line of action (alternate long and short dash line in drawing 20 (b)) of the weight when being in the condition of balance, and the line of action (continuous line in drawing 20 (b)) of the buoyancy when inclining.

[0128] Like this example, since the metacenter of the solid form semiconductor device 210 is in a location higher than a center of gravity, a couple (stability) acts on the sense which it is going to return to the location of balance of origin. This stability: T is [0129].

[Equation 10]

T=Whsintheta=Fhsintheta=rhogVhsintheta (> 0)

It is come out and expressed. Here, V and specific weight of the solid form semiconductor device 210 are set to rhog for the volume of the liquid which the solid form semiconductor device 210 eliminated.

[0130] So, in order to just carry out this stability, being set to h> 0 is a necessary and sufficient condition.

[0131] From drawing 20 (b) [to 0132 [and]]

[Equation 11]

$$h = (I/V) - \overline{CG}$$

[0133] It becomes. Here, I is the moment of inertia of the circumference of O shaft. Therefore, [0134]

[Equation 12]

$$(I/V) > \overline{CG}$$

[0135] The ball form semiconductor device 210 stabilizes and floats in ink, and becoming becomes a requirement for performing supply of the dielectric electromotive force from an external resonance circuit, and two-way communication with the means of communications of the component exterior.

[0136] Drawing 21 is the outline block diagram of the ink tank using the solid form semiconductor device by the gestalt of operation of the 2nd of this invention. The ink tank 541 shown in drawing 21 is equipped with the 2nd room of the atmospheric-air free passage condition which are the 1st room in the full sealing condition of holding ink 547, and the negative pressure room which contains the negative pressure generating member 546, and the free passage way 548 which makes the 1st room and the 2nd room open for free passage at the tank bottom like drawing 13 R> 3. From the ink feed hopper 549 formed in the part of the opposite side, the ink of the 2nd interior of a room is consumed in the 2nd room the free passage way 548 side in the wall which constitutes the 2nd room. By this ink tank 541, the solid form semiconductor devices 1 and 2 are arranged in the 1st interior of a room, and the solid form semiconductor devices 3 and 4 are arranged in the 2nd interior of a room.

[0137] Like drawing 21 (a), the solid form semiconductor device 2 is floating near the oil level of the ink 547 of the 1st interior of a room of the ink tank 541, and can carry out induction of the electromotive force by electromagnetic induction from the external resonance circuit besides the ink tank 541, and can generate resonance frequency. On

the other hand, the solid form semiconductor device 1 fixed to the upper wall in the ink tank 541 is accumulated in an information storage means, generates resonance frequency further, and can transmit the information on the ink in the ink tank 541 outside while it receives the resonance frequency signal which was made to carry out induction of the electromotive force by electromagnetic induction, and was generated from the solid form semiconductor device 2 from the external resonance circuit besides the ink tank 541. In this case, although the functions of the solid form semiconductor devices 1 and 2 differ, both may have a reverse function and both may have the same function.

[0138] Next, how to detect the amount of ink in the ink tank 541 is explained. By operating the solid form semiconductor devices 1 and 2, the condition of the ink of drawing 21 (a) is set up as an initial state. The amount of ink is detectable by operating the solid form semiconductor devices 1 and 2 similarly in the condition of drawing 21 (b) that the amount of ink decreased, from this condition. Here, although two points, drawing 21 (a) and (b), were explained, the amount of ink is detectable serially by operating the solid form semiconductor devices 1 and 2 periodically. Change of the amount of ink at that time and the condition of the signal outputted are shown in drawing 22 .

[0139] On the other hand, the ink 547 of the 1st room is lost and detection of the amount of ink in the 2nd room (negative pressure generating room) which contained the negative pressure generating member 546 is explained.

[0140] Like drawing 21 (a), the solid form semiconductor devices 3 and 4 are beforehand fixed to a position in the 2nd room. For example, in the example shown in drawing 21 , the solid form semiconductor device 3 is fixed to the upper wall of the 2nd interior of a room, and the solid form semiconductor device 4 is being fixed to the base of the 2nd interior of a room. In this 2nd room, the difference in the resonance frequency detected between the solid form semiconductor device 3 and 4 by the amount of ink in the negative pressure generating member 546 is used. Whenever it sets up a signal output beforehand so that it may be in agreement with the terminal point of the 1st room in the condition in early stages of the 2nd room, a signal output performance diagram like drawing 22 is obtained, and the amount of ink in the ink tank 541 can be detected.

[0141] Thus, it is possible by using two or more solid form semiconductor devices to be able to detect the amount of ink in the ink tank 541, and to detect the amount of ink of the 1st room and the 2nd room according to an individual especially. Moreover, by using two or more solid form semiconductor devices, a setup of the initial state especially in the 2nd room is attained, and when the ink in the ink tank 541 carries out memory of

the full condition, the comparison with the condition is performed (differential detection), and it becomes detectable [the more exact amount of ink].

[0142] Thus, in the solid form semiconductor device of this invention, it is made to operate using the energy from the outside, the amount of ink in an ink tank etc. is judged, and it is required that exact information should be transmitted outside at high speed. However, the component which requires an advanced technique for being stabilized from the outside in the recording head (ink tank) accompanied by actuation, and giving energy, and operates with low power as much as possible is required. Moreover, the memory of the non-volatile which can hold information even if it does not always continue giving energy, and can rewrite information if needed is required. Furthermore, for a miniaturization to be required and to produce like other components for that purpose using the usual semi-conductor process is demanded from the need of constituting in a solid form semiconductor device, and this becomes advantageous also in the point of cost.

[0143] From the above viewpoint, it found out that FeRAM which consists of a ferroelectric was the optimal as an information storage means with which the solid form semiconductor device of this invention was equipped. As a description of a strong dielectric material used by FeRAM, a memory function occurs to electric field, and it can have a non-volatile, maintaining the rapidity of DRAM by using this as a dielectric of the memory capacitor in the conventional DRAM. Thus, when it uses a solid form semiconductor device by the ink tank that data do not disappear even when a power source is unstable, since it is that rapid access is possible and a non-volatile, it becomes effective. Thus, by accumulating are recording information in FeRAM, exact information processing is performed, and an exchange of an external device and a bidirectional signal is a high speed, and it becomes possible to drive by the low battery.

[0144] Generally, a strong dielectric material has high specific inductive capacity to it and coincidence, and can form a mass capacitor in them. Therefore, while being able to perform the wireless communication link without wiring between an ink tank and a recording device, it is effective in the communication link degree of freedom of a solid form semiconductor device increasing. Here, if the capacitance of the capacitor formed in L and a solid form semiconductor device in the inductance of the coil formed in the solid form semiconductor device is set to C, the communication link frequency f of a solid form semiconductor device will be obtained by the following formula.

[0145]

[Equation 13]

$$f = \frac{1}{2\pi\sqrt{LC}}$$

[0146] Therefore, if the ferroelectric film is utilized also as a capacitor at the time of the membrane formation of a strong dielectric material of FeRAM which is an information storage means, the KYAPA stance C of a solid form semiconductor device can be enlarged, and it will become possible to make small the communication link frequency of a solid form semiconductor device. Therefore, communicating [of a solid form semiconductor device] becomes possible also for low frequency, and a communicative degree of freedom becomes high.

[0147] Next, the manufacture approach of the ferroelectric used for FeRAM which is the information storage means of this invention is explained.

[0148] Drawing 23 is the schematic diagram showing the ECR plasma CVD system used for this manufacture approach.

[0149] By the manufacture approach explained based on drawing 23 , the ferroelectric film is formed using an ECR plasma-CVD method, using TiO3 (BST: barium titanate strontium) as a component (Ba-Sr) of the ferroelectric thin film of FeRAM which is the information storage means of a solid form semiconductor device.

[0150] Ba (DPM) [bis-dipivaloylmethanate barium]2, and Sr (DPM)2, Ti (O-i-C3H7)4 and O2 are used for the ingredient of the ferroelectric thin film formed of ECR plasma CVD. Ba (DPM)2 and Sr (DPM)2 are the elevated temperatures respectively near the melting point, and as shown in drawing 23 , they are supplied in the chamber 362 of equipment by using Ar gas as a carrier. Moreover, Ti (O-i-C3H7)4 is supplied in a chamber 362 by carrying out a hub ring by Ar gas which is carrier gas. On the other hand, O2 gas is also supplied in a chamber 362. Within the chamber 362, spherical silicon is held on the sample base 363.

[0151] Next, the above-mentioned ingredient which introduced 2.54GHz microwave through the magnet coil 361, and was introduced in the chamber 362 in the chamber 362 is made to plasma-ize. Thereby, those ingredients arrive at the front face of the sample base 363 which holds spherical silicon within a chamber 362, and the ferroelectric thin film which changes from a ferroelectric ingredient to the front face of the spherical silicon on the sample base 363 is formed. In order to form a ferroelectric thin film in the front face of spherical silicon at homogeneity, the sample base 363 may be rotated, or membranes may be made move and formed.

[0152] In addition, by the above-mentioned approach, how to form using an ECR plasma-CVD method was explained. however, formation of a ferroelectric thin film is

restricted to these processes -- not having -- these -- others -- a plasma-CVD method, a heat CVD method, and MOCVD (Molecular Organic CVD) -- forming using law, the sputtering method, etc. is possible.

[0153] Although shown above, as an ingredient of a ferroelectric thin film moreover, otherwise PZT (titanic-acid lead zirconate : [the solid solution of PbZrO3 and PbTiO3]) :P b-Zrx-Ti1-xO3, SBT(tantalic acid bismuth strontium):Sr-Bi2-Ta2O9, SrTiO3 (STO: strontium titanate), BaTiO3 (BTO: barium titanate) or PLZT(metallic oxide which added La to PZT, i.e., the solid solution of PbZrO3 and PbTiO3):(Pb, La)-(Zr, Ti) O3 grade can be used.

[0154] The wireless LAN system using a microwave band frequency as the two-way communication approach with the external means of communications at this time and the wireless local loop using a submillimeter wave and a millimeter wave band frequency are applicable.

[0155] Here, the outline of transmission and reception by the wireless LAN system is explained. Below, the data transmission to a recording apparatus from a solid form semiconductor device is described. In addition, when performing data transmission to a solid form semiconductor device from a recording apparatus side conversely, Data ID are arranged on the side, respectively and it is identified by it.

[0156] In the solid form semiconductor device of a transmitting side, it has the Rhine Monitoring Department, the data handling section, the acknowledgement check section, and the error-processing section, and the data handling section, the acknowledgement section, the error-processing section, a display, etc. are attached to the recording apparatus of a receiving side.

[0157] The flow chart in the solid form semiconductor device of a transmitting side is shown in drawing 24 . By decided transmitting pro KOTORU, when transmitting data, after performing initial setting, the address of a receiving side is set up and data are transmitted. It resends, when the collision of a signal does not occur or acknowledgement does not come on the contrary from the equipment of the specified receiving side during transmission. During actuation, it displays about the condition of Rhine, or the existence of acknowledgement on the display prepared in the recording device of a receiving side etc., and is ******** about decision adequate to a user.

[0158] The flow chart in the recording apparatus of a receiving side is shown in drawing 2525 . In this receiving side, if the Rhine monitor is always performed and its address is checked, data are incorporated from Rhine and it accumulates in the buffer on main memory. During reception, when the block mark in every 16 bytes cannot be checked or a checksum is not in agreement by the error detection processing after reception

termination, as a reception error, reception is interrupted, Rhine is supervised again, and it waits for arrival of a header. When it is able to receive errorless, receiving contents are displayed on a display.

[0159] Although electromagnetic induction with a coil was used in the above solid form semiconductor devices of an example as external energy which supplies the power which starts a component , when light may be use in addition to this and it changes the light and darkness of this light into an electrical signal , power can be generate according to the photoconductive effect using the ingredient (for example , photoconductor) from which resistance changes with the exposures of light . As photoconductor, a binary alloy/ternary alloys, such as CdS, InSb, and Hg0.8Cd0.2Te, GaAs, Si, Va-Si, etc. are used. Furthermore, when using heat as electromotive force, power can be generated according to the quantum effectiveness from the radiant energy of the matter.

[0160] Moreover, the solid form semiconductor device of this example supplies the ink held in the ink tank with which it was equipped removable to an ink-jet recording head, detects the ink information and the tank information about the ink jet printer printed in a record form by the ink droplet injected from the recording head, transmits this information to this ink jet printer, and control a printer by the optimal approach or it is preferably applied to the ink jet printer which carries out the control which carries out optimal maintenance of the condition in a tank.

[0161] In addition, although sheathing of an ink jet recording apparatus was not illustrated in this example, if light is used as a means of communication using what the condition of inside, such as translucence, can be regarded as in covering of sheathing when an ink tank also uses a translucent thing, since a user can be seen in the light of a tank, "a thing [a thing] to exchange tanks, for example" is intelligible, and can give a user the volition which is going to exchange tanks. (Although the carbon button of the body of equipment shines conventionally, since it serves as some display functions, it is unclear for a user in wanting whether to tell what is light.)

[0162]

[Effect of the Invention] According to the solid form semiconductor device of this invention, the conversion means of external energy, the acquisition means of the environmental information of the exterior which operates with the energy changed with this energy conversion means -- and By being FeRAM which is equipped with an information storage means, a decision means to compare and judge acquisition information and are recording information, and a signal transduction means to display or transmit acquisition information to the exterior, and an information storage means

becomes from a ferroelectric Taking advantage of the configuration of the solid form of this component, perimeter environmental information can come to hand efficiently. Furthermore, in case it has the means of communications which receives the signal from the outside, the information according to this input signal comes to hand and a comparative judgment result with are recording information is transmitted to the exterior with that acquisition information, by accumulating that are recording information in FeRAM which is the nonvolatile memory which consists of a ferroelectric, exact information processing is performed, and an exchange of an external device and a bidirectional signal is a high speed, and driving by the low battery is possible. Furthermore, by, utilizing the strong dielectric material of FeRAM as a capacitor, the capacitance of a solid form semiconductor device can be enlarged, and in case a solid form semiconductor device communicates with the exterior, the degree of freedom of a communication link of a solid form semiconductor device becomes high.

[0163] Moreover, it is possible to make the information about the ink which held such a solid form semiconductor device in the ink tank by allotting more than one in an ink tank, the pressure in a tank, etc. transmit to for example, an external ink jet recording device on real time. When controlling the amount of negative pressure in the tank which changes every moment for example, with ink consumption and stabilizing the ink jet regurgitation, rapidity, a low power, and the size to which it comes from constraint of a tooth space are required, and this is these points and becomes advantageous by accumulating are recording information in FeRAM which consists of a ferroelectric.

[0164] Furthermore, since it is the configuration which supplies the external energy for operating a solid form semiconductor device by non-contact, it is not necessary to give the energy source for starting of a component to an ink tank, or to connect wiring for energy supply to a component, and giving direct wiring with the exterior can use it for a difficult part.

[0165] For example, when starting energy of a component is made into power, by forming so that the conductor coil of an oscillator circuit may be twisted around the outside surface of a solid form semiconductor device as an external energy conversion means, a conductor coil is made to generate power by electromagnetic induction between external resonance circuits, and power can be supplied to a component by non-contact.

[0166] In this case, since the coil is twisted around the outside surface of a component, the magnitude of the inductance of that coil changes according to the residue in an ink tank (for example, ink), ink concentration, and Ink pH. Therefore, since an oscillator circuit changes an oscillation frequency according to change of the inductance, it is also

possible to detect the residue of the ink in an ink tank etc. based on change of the oscillation frequency changed.

[0167] And while a solid form semiconductor device has the cavernous section for floating in liquid Since the center of gravity of a component is formed so that it may be located below the core of the component concerned For example, even if the recording head and ink tank which were carried in the ink jet recording device operate serially and the ink in an ink tank rocks vertically and horizontally The information about ink, the pressure in a tank, etc. are detectable with a sufficient precision, being stabilized and floating in the ink in an ink tank. Moreover, the coil of the above-mentioned oscillator circuit formed in the component is held in the location stabilized to the coil of an external resonance circuit, and always stabilized two-way communication is also made possible.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is a block block diagram showing the internal configuration of the solid form semiconductor device by the gestalt of operation of the 1st of this invention, and the exchange with the exterior.

[Drawing 2] It is a flow chart for explaining actuation of the component shown in drawing 1 .

[Drawing 3] It is a block block diagram showing the internal configuration of the solid form semiconductor device by the gestalt of operation of the 2nd of this invention, and the exchange with the exterior.

[Drawing 4] It is a flow chart for explaining actuation of the component shown in drawing 3 .

[Drawing 5] It is a block block diagram showing the internal configuration of the solid form semiconductor device by the gestalt of operation of the 3rd of this invention, and the exchange with the exterior.

[Drawing 6] It is drawing showing the location of the component of the configuration of drawing 3 made to float in the ink of an ink tank with consumption change of ink.

[Drawing 7] It is a flow chart for checking the location of the component of a configuration of being shown in drawing 3 , and judging the need for tank exchange.

[Drawing 8] It is a conceptual diagram for explaining the operation of the solid form semiconductor device which is the gestalt of operation of the 4th of this invention.

[Drawing 9] It is drawing showing the example which has arranged the solid form semiconductor device which combined suitably the gestalt of the 1st, the 2nd, or the 3rd operation, respectively in the ink jet head linked to the inside of an ink tank, and this.

[Drawing 10] It is drawing showing the example of a configuration which carries out the sequential transfer of the electromotive force supplied to a certain solid form semiconductor device within the ink jet head linked to the inside of an ink tank, and

this with information at other solid form semiconductor devices.

[Drawing 11] It is drawing showing the example of a suitable ink tank to allot the solid form semiconductor device by the gestalt of various operations of this invention.

[Drawing 12] It is drawing showing the example of a suitable ink tank to allot the solid form semiconductor device by the gestalt of various operations of this invention.

[Drawing 13] It is drawing showing the example of a suitable ink tank to allot the solid form semiconductor device by the gestalt of various operations of this invention.

[Drawing 14] It is drawing showing the example of a suitable ink tank to allot the solid form semiconductor device by the gestalt of various operations of this invention.

[Drawing 15] It is the perspective view showing an example of an ink jet recording device which carries the ink tank shown in drawing 11 - drawing 14 , etc.

[Drawing 16] It is drawing for explaining the power generating principle of the energy conversion means which is the component of the solid form semiconductor device of this invention.

[Drawing 17] It is process drawing for explaining an example of the manufacture approach of the solid form semiconductor device of this invention.

[Drawing 18] It is the typical sectional view cut so that it might travel through N-MOS circuit component used for the solid form semiconductor device of this invention.

[Drawing 19] It is drawing showing the cellular structure of ferroelectric random-access memory.

[Drawing 20] It is drawing for explaining the conditions for holding the condition that the solid form semiconductor device manufactured by the approach shown by drawing 17 was stabilized in the liquid.

[Drawing 21] It is drawing showing the example of a suitable ink tank to allot the solid form semiconductor device by the gestalt of various operations of this invention.

[Drawing 22] It is drawing for explaining detection of the amount of ink by the example of this invention.

[Drawing 23] It is the schematic diagram showing the ECR plasma CVD system used in case the ferroelectric of FeRAM in the solid form semiconductor device of this invention is manufactured.

[Drawing 24] It is drawing showing the flow chart in the solid form semiconductor device of a transmitting side in case the solid form semiconductor device and recording apparatus by the example of this invention perform two-way communication.

[Drawing 25] It is drawing showing the flow chart in the recording apparatus of a receiving side in case the solid form semiconductor device and recording apparatus by the example of this invention perform two-way communication.

[Drawing 26] It is drawing showing the ink residue detection equipment of a publication in JP,6-143607,A.

[Drawing 27] It is drawing showing [****** / No. 2947245] the ink residue detection equipment of a publication.

[Description of Notations]

11, 21, 31, 41-43, 51-53, 61-63, 71, 79, 81-83 Solid form semiconductor device

12, 22, 32 Electromotive force

13, 23, 33 Power

14, 24, 34 Energy conversion means

15 25 Information acquisition means

16 26 Decision means

17 27 Information storage means

18 28 Means of signal transduction

29 Receiving Means

30 Input Signal

35 Buoyancy Generating Means

36 Ink Feed Hopper

37 Negative Pressure Generating Member

72 Ink Tank

73 Ink

74 Ink Feed Hopper

75 Liquid Route

76 Liquid Room

77 Delivery

78 Ink Jet Recording Head

101 External Resonance Circuit

102 Oscillator Circuit

201 Spherical Silicon

202 SiO2 Film

203 Opening

204 Cavernous Section

205 SiN Film

206 Cu Film

207 Closure Member

210 Ball Form Semiconductor Device

350 Ferroelectric

351 Up Electrode
352 Plate Line (Lower Electrode)
353 Pit Line
354 WORD Line (Gate Electrode)
361 Magnet Coil
362 Chamber
363 Sample Base

[Translation done.]